RDS-1 / product 501

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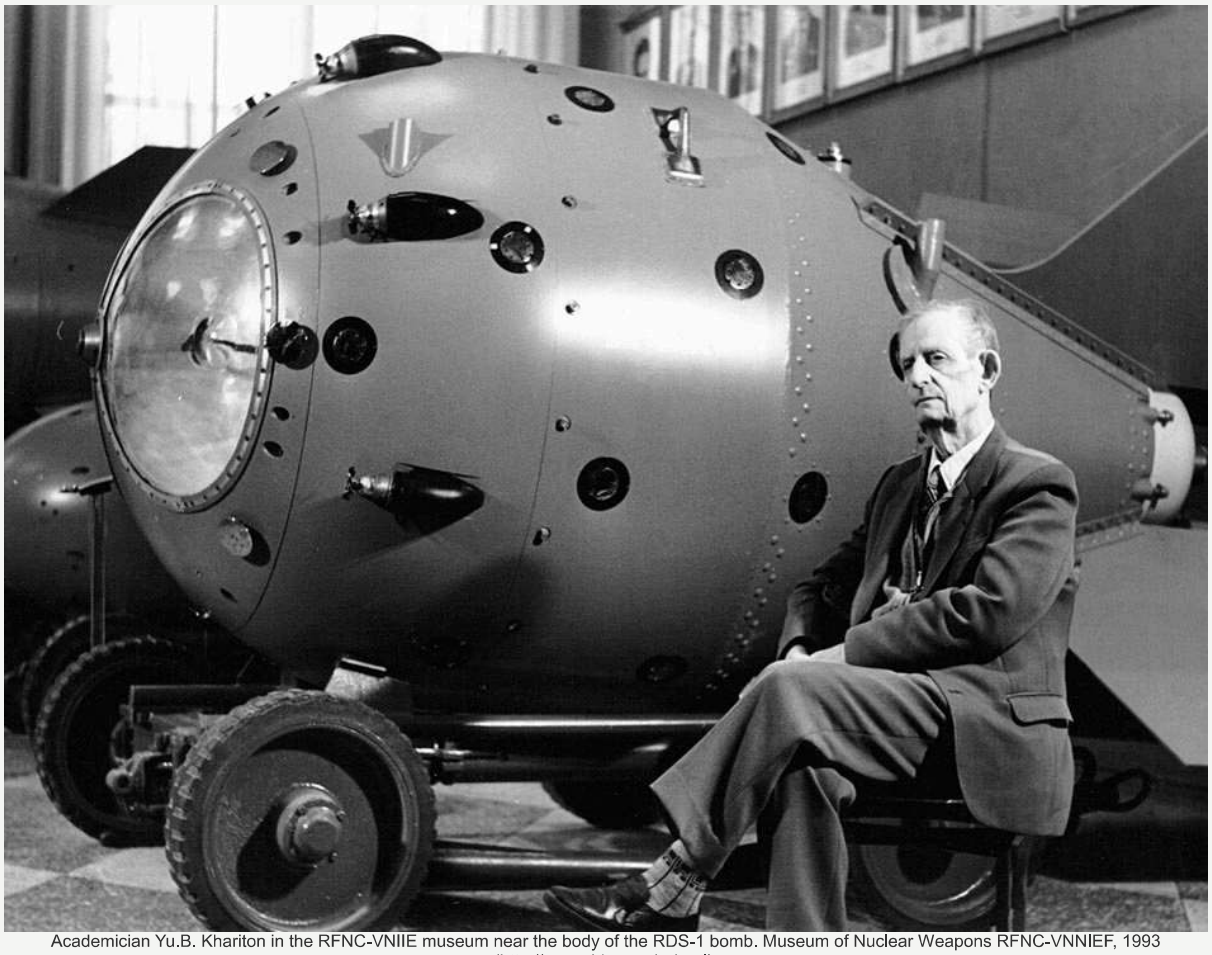
DATA AS OF 2025 (standard replenishment)
RDS-1 / S-1 / product 501
★★★★

The first domestic atomic bomb. The RDS-1 atomic bomb was developed by Design Bureau No. 11 of the Measuring Instruments Laboratory No. 2 of the USSR Academy of Sciences (since 1950, the Design Bureau was transferred to the structure of the First Main Directorate under the USSR Council of Ministers) in accordance with the scientific and technical requirements of the scientific director of work on the creation of atomic weapons, Academician Kurchatov (Measuring Instruments Laboratory No. 2 of the USSR Academy of Sciences, created in February 1943) and the chief designer of Design Bureau No. 11 Yu.B.Khariton. On August 20, 1945, a special committee for the creation of domestic atomic weapons was created under the State Defense Committee of the USSR, the chairman of the committee was L.P.Beria. On August 30, 1945, for the practical implementation of the task of creating atomic weapons, the First Main Directorate was created under the Council of People's Commissars of the USSR, headed by B. L. Vannikov. On December 10, 1945, the first meeting of the scientific and technical council of the PGU was held. On April 9, 1946, by Resolution of the Council of Ministers of the USSR No. 805-327ss / op "Questions of Laboratory No. 2", KB-11 was created, chief designer - Yu. B. Khariton, head of the design bureau - P. M. Zernov.

When creating the first domestic atomic bomb, intelligence data was widely used - in particular, a detailed diagram of the American atomic bomb, which was handed over to Soviet intelligence by Klaus Fuchs. The value of the information received from Fuchs was confirmed by Yu. B. Khariton for the first time at a conference of the first nuclear weapons developers, which took place at VNIIEF in April 1992, and then in an article in the Izvestia newspaper on December 8, 1992 (source). The development of the bomb systems was carried out by domestic scientists, but the receipt of intelligence data on similar work in the USA allowed for a significant acceleration of the development, although it led to the continuity of technical solutions.



Academician Yu.B. Khariton in the RFNC-VNIIE museum near the body of the RDS-1 bomb. Museum of Nuclear Weapons RFNC-VNNIEF, 1993 (http://rusarchives.ru/school).

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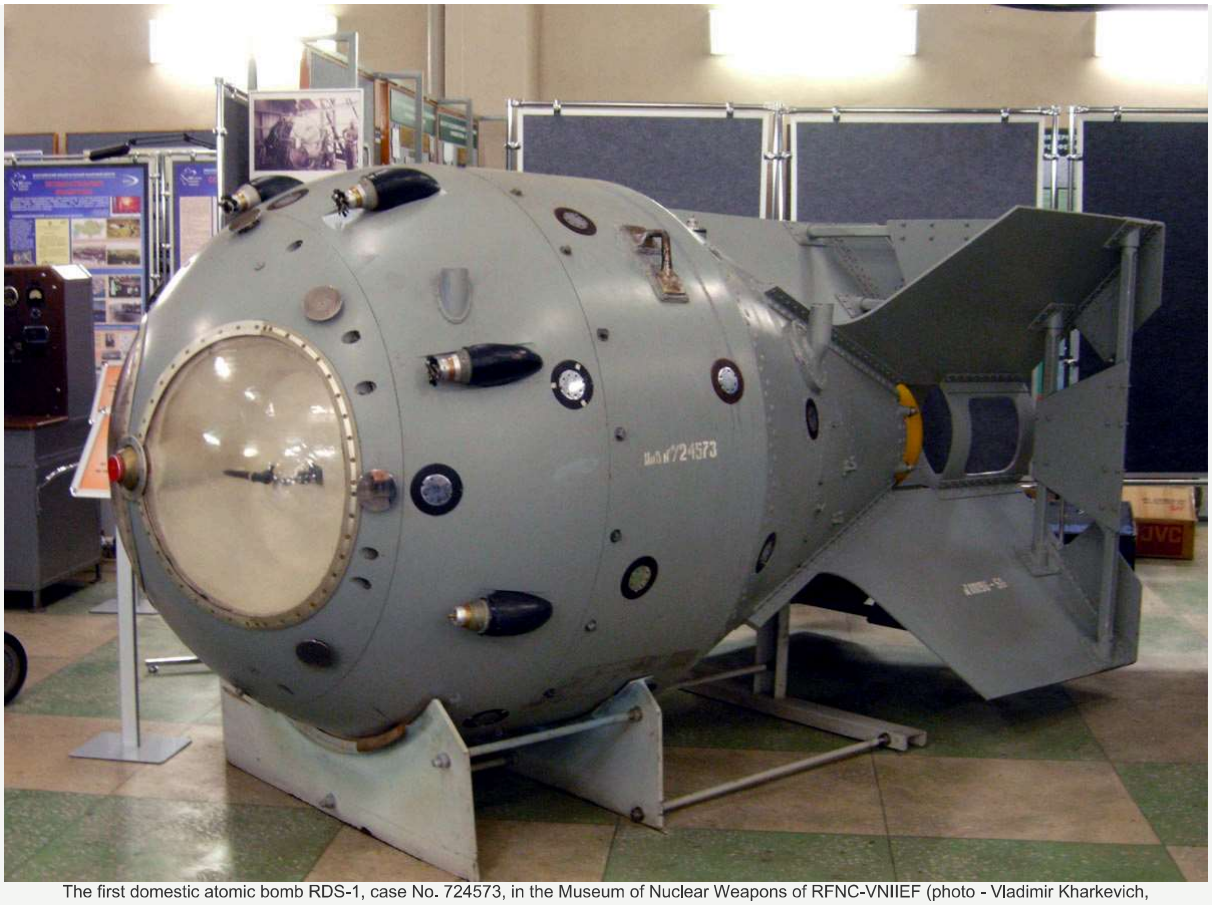
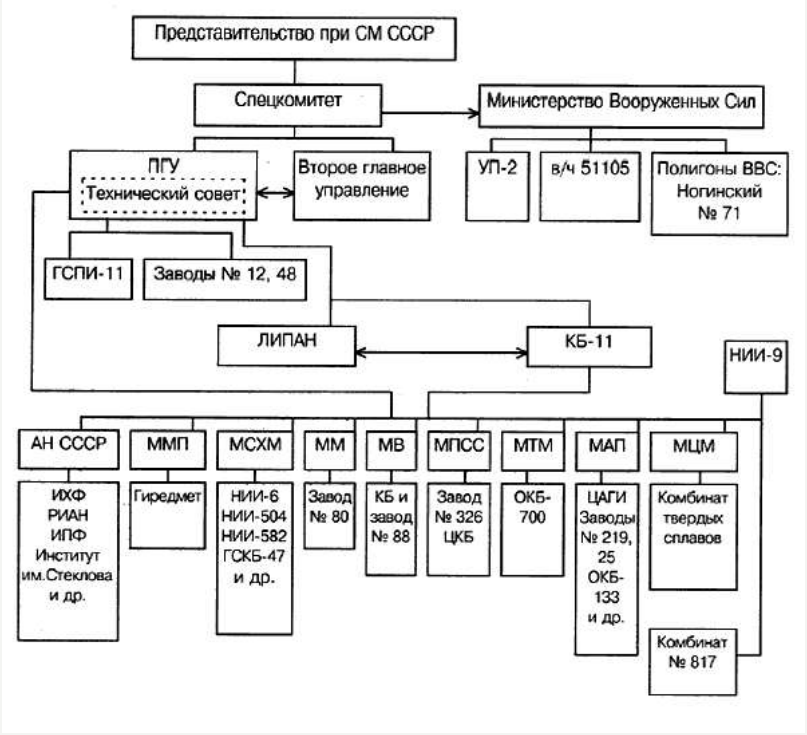


The first domestic atomic bomb RDS-1, case No. 724573, in the Museum of Nuclear Weapons of RFNC-VNIIEF (photo - Vladimir Kharkevich, http://www.panoramio.com).

For the needs of creating the experimental bomb, KB-11 was transferred to Plant No. 550 of the USSR Ministry of Agriculture and Machine Building. In the spring of 1946, the KB-11 laboratories began work:
- Laboratory No. 1 - headed by M. Ya. Vasiliev (from NII-6), research and development of focusing systems of full-size sizes;
- Laboratory No. 2 - headed by A. F. Belyaev (Institute of Chemical Physics), research into the detonation of explosives;
- Laboratory No. 3 - headed by V. A. Tsukerman, development of methods for ultra-high-speed radiography of fast processes of explosion and compression of a metal core in a spherical charge, as well as development of methods for measuring the speed of movement of the mass of explosion products;
- Laboratory No. 4 - headed by L. V. Altshuler (Institute of Mechanical Engineering of the USSR Academy of Sciences), determination of the state of matter at ultra-high pressures (under the influence of a shock wave of a spherical charge), study of the central part of the charge;
- Laboratory No. 5 - headed by K. I. Shchelkin (First Deputy Chief Designer), research of nuclear charge in full-scale tests and creation of special equipment, which was necessary for registration of processes occurring in this case;
- Laboratory No. 6 - headed by E. K. Zavoisky (from Kazan University), measurements of compression of the central part;
- Laboratory No. 7 - headed by A. Ya. Apin (Institute of Chemical Physics), development of a neutron fuse;
- Laboratory No. 8 - headed by N. V. Ageyev (Institute of General and Organic Chemistry), research of problems of uranium and plutonium, technological aspects of study of their properties and characteristics for the purpose of application of these materials in the design of atomic bomb;
- Laboratory No. 9 (formed in January 1948) - headed by G. N. Flerov, measurements of critical masses, study of characteristics of interaction of fast neutrons with nuclei of heavy elements and nuclear fission, creation of unique equipment for conducting experiments;
- Laboratory No. 10 (founded in 1948) - director A.P. Protopopov, neutron-physical measurements;
- design divisions - were formed under the direction of V.A. Turbiner. In mid-1948, during the reorganization of the design divisions, two sectors were created:
- - Scientific Design Sector 1 - director N.L. Dukhov.
- - Scientific Design Sector 2 - director V.I. Alferov.
In 1950, the sectors were combined into one sector under the direction of N.L. Dukhov, which solved the following problems:
- development of the ballistic body of the bomb;
- development of the charge itself;
- development of the automation system;
- creation of the electric initiation system of the charge;
- development of control and bench equipment for the automation system, radio control equipment, etc.
Also in February 1948, theoretical department No. 50 was created in KB-11, headed by Ya. B. Zeldovich.



Infrastructure for the creation of the RDS-1 product:
MMP - Ministry of Metallurgical Industry;
MPSS - Ministry of Communications Production;
MSHM - Ministry of Agricultural Machinery;
MTM - Ministry of Transport Machinery;
MV - Ministry of Armaments;
MAP - Ministry of Aviation Industry;
MCM - Ministry of Non-Ferrous Metallurgy;
MM - Ministry of Mechanical Engineering
(source)

On June 21, 1946, by Resolution of the Council of Ministers of the USSR No. 1286-525ss "On the plan for the development of work of Design Bureau No. 11 at Laboratory No. 2 of the USSR Academy of Sciences" the tasks and deadlines for their implementation were stipulated:
"1. To oblige Design Bureau No. 11 (Comrades Khariton, Zernov):
a) to create, under the scientific supervision of Laboratory No. 2 of the USSR Academy of Sciences (Academician Kurchatov), the "Reactive Engine S" (abbreviated "RDS") in two versions - with the use of heavy fuel (version S-1) and with the use of light fuel (version S-2);
b) to present the tested and manufactured first "RDS" in versions S-1 and S-2, 1 copy of each version, for state testing in stationary conditions: for version S-1 - by January 1, 1948, for version S-2 - by 1 June 1948;
c) the first developed and manufactured "RDS" in aviation design in the S-1 and S-2 variants, 1 copy of each variant, to be presented for state flight tests: for the S-1 variant - by March 1, 1948, for the S-2 variant - by January 1, 1949.
2. In order to ensure the tasks specified in paragraph 1, Design Bureau No. 11 (Commissioned Officer) is obliged to Khariton and Zernov) to perform the following work:
a) to develop tactical and technical specifications for the "RDS" design for variants S-1 and S-2 by July 1, 1946."

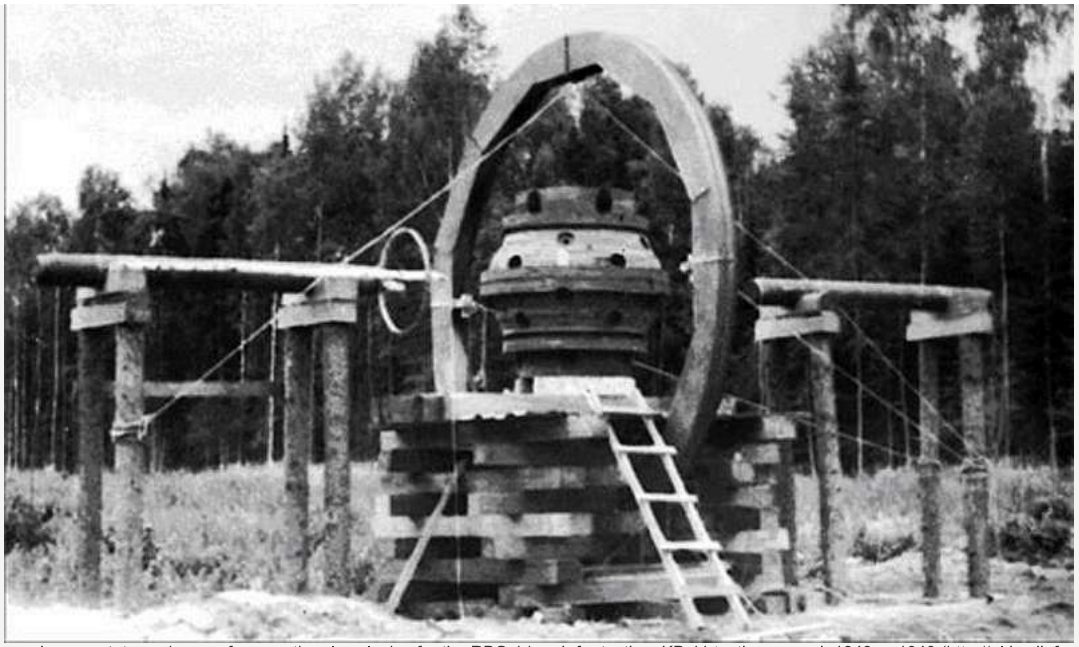
Option S-1 was understood to be **a plutonium bomb using the imlosion principle** , which we now know as RDS-1, S-2 - RDS-2 - a uranium bomb of the "gun" type - the first version of a bomb with this name. "Heavy fuel" - plutonium-239, "light fuel" - uranium-235.

On July 1, 1946, Chief Designer Yu. B. Khariton signed the "Tactical and Technical Assignment for the Atomic Bomb" (TTZ), which was sent to the head of the First Main Directorate under the USSR Council of Ministers B. L. Vannikov. The technical assignment consisted of 9 points and stipulated the type of nuclear fuel, the method of transferring it through a critical state, the overall mass characteristics of the atomic bomb, the different timing of the electric detonators, the requirements for the high-altitude fuse and the self-destruction of the product in the event of failure of the equipment that ensures the operation of this fuse. In accordance with the TTZ, it was envisaged to develop two versions of atomic bombs - an implosion type on plutonium and a uranium one with gun approach. The length of the bomb was not to exceed 5 meters, the diameter - 1.5 meters, and the weight - 5 tons.

The following institutions are involved in the preparatory design and research work related to the implementation of the atomic bomb (the design of individual components of the bomb): Research Institute No. 6, Research Institute No. 504, Design Bureau No. 47 of the Ministry of Agricultural Machinery, Design Bureau No. 88 of the Ministry of Armaments, Design Bureau of the Kirov Plant (Chelyabinsk) of the Ministry of Transport Machinery, and the Institute of Chemical Physics of the USSR Academy of Sciences.

The development of the design of the actual RD-1 atomic charge (called RDS-1 in the second half of 1946) was started at NII-6 in late 1945. The development began with a charge model on a scale of 1/5 of the actual size. The work was carried out without a technical specification, but solely on the oral instructions of Yu. B. Khariton. The first sketches were made by N. A. Terletsky, who worked at NII-6 in a separate room, where only Yu. B. Khariton and E. M. Adaskin, deputy director of NII-6, were allowed to enter. He carried out the general coordination of work with other groups that had begun developing high-speed detonators to ensure synchronous detonation of a group of electric detonators and work on the electrical activation system. A separate group began to select explosives and manufacturing technologies for unusual shapes of parts from explosives. The model was developed at the beginning of 1946, and by the summer, two copies were manufactured. The model was tested at the NII-6 testing ground in Sofrino. By the end of 1946, the development of documentation for a full-scale charge had begun, the development of which began to be carried out in KB-11, where at the beginning of 1947 in Sarov, the initial minimum conditions for the manufacture of blocks and the conduct of blasting operations were created (parts from explosives, before the commissioning of Plant No. 2 in KB-11, were supplied from NII-6).

If by the beginning of the development of atomic charges, domestic physicists were to some extent prepared for the subject of creating an atomic bomb (based on their previous work), then for explosives designers this subject was completely new. They did not know the physical foundations of the charge, new materials used in the design, their physical and mechanical properties, the admissibility of joint storage, etc. The large dimensions of the parts made of explosives and their complex geometric shapes, strict tolerances required solving many technological problems. Thus, specialized enterprises of the country did not undertake the manufacture of a large-sized charge body, and Experimental Plant No. 1 (KB-11) had to make a sample body, after which these bodies began to be manufactured at the Kirov Plant in Leningrad. Large-sized parts made of explosives were initially also manufactured at KB-11.



Preparing a prototype charge of conventional explosive for the RDS-1 bomb for testing, KB-11 testing ground, 1948 or 1949 (http://old.vniief.ru).

Testing a prototype charge of conventional explosive for the RDS-1 bomb, KB-11 testing ground, 1948 or 1949 (http://old.vniief.ru).

On December 25, 1946, the first uranium-graphite nuclear reactor in Europe and Asia, F-1, was launched (in Laboratory No. 2 of the USSR Academy of Sciences, now the Kurchatov Institute). On February 8, 1948, the USSR Council of Ministers adopted a Resolution on postponing the test date of the first atomic bomb by 1 year - to March 1, 1949. The first industrial reactor "A" at Plant No. 817 was launched on June 19, 1948, and on June 22, 1948, the reactor reached its design capacity and was decommissioned only in 1987. To separate the produced plutonium from nuclear fuel, a radiochemical plant (Plant "B") was built as part of Plant No. 817 (Chelyabinsk-40, now Ozersk). The irradiated uranium blocks were dissolved and the plutonium was separated from the uranium using chemical methods. The concentrated plutonium solution was subjected to additional purification from highly active fission products in order to reduce its radiation activity when it was delivered to the metallurgists. In April 1949, Plant "V" began manufacturing bomb parts from plutonium using the NII-9 technology. At the same time, the first heavy water research reactor was launched. The development of the production of fissionable materials was difficult, with numerous accidents during the elimination of the consequences of which there were cases of overexposure of personnel (at that time, such trifles were not paid attention to). By July, a set of plutonium charge parts was ready. A group of physicists led by Flerov went to the plant to conduct physical measurements, and a group of theoreticians led by Zeldovich went to process the results of these measurements, calculate the efficiency values and the probability of an incomplete explosion (source).

Installation of the F-1 reactor, 1946 (Atom No. 74 / 2017)

Flight and ballistic tests of the RDS-1 bomb body and mock-ups with Tu-4 carrier aircraft were carried out at the 71st testing ground of the USSR Air Force (Bagerovo, Crimea), which was created in the fall of 1947. In 1948 and early 1949, the following were carried out at the testing ground (*history - Atomic Era*):
- flight and ballistic tests of mass and dimensional mock-ups of the RDS-1 during bombing from Tu-4
- flight tests of mock-ups of products with recording equipment that recorded the loads acting on the product during its use
- laboratory and ground tests of some automation units
- takeoff and landing tests of Tu-4 carriers with mock-ups of products

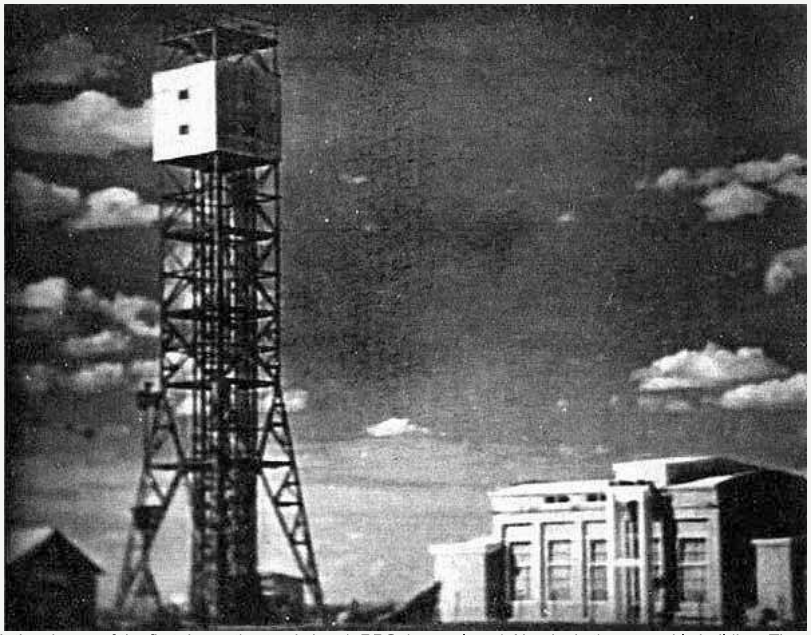
Due to the uncertainty of the power of a nuclear explosion, a decision was made to test the RDS-1 in a ground-based stationary version.

By a resolution of the USSR Council of Ministers in February 1948, the deadlines for completing the main task of the atomic project were adjusted - Yu.B. Khariton and P. M. Zernov were ordered to ensure the manufacture and presentation of one complete RDS-1 atomic bomb for state testing by March 1, 1949. The following research projects were highlighted:
- completion of the development of a spherical charge of explosives by May 1948;
- study of the problem of metal compression during the explosion of an explosive charge by July 1948;
- development of a neutron fuse design by January 1949;
- determination of the critical mass and assembly of plutonium and uranium charges for RDS-1 and RDS-2. Ensuring the assembly of the plutonium charge for RDS-1 by February 1, 1949.

In 1948, Plants No. 1 and No. 2 were created within the structure of KB-11 to develop pilot production. The first atomic bomb was manufactured at these plants and small-scale production of the first series of bombs was mastered. The final mass of the plutonium charge was determined in July 1949.

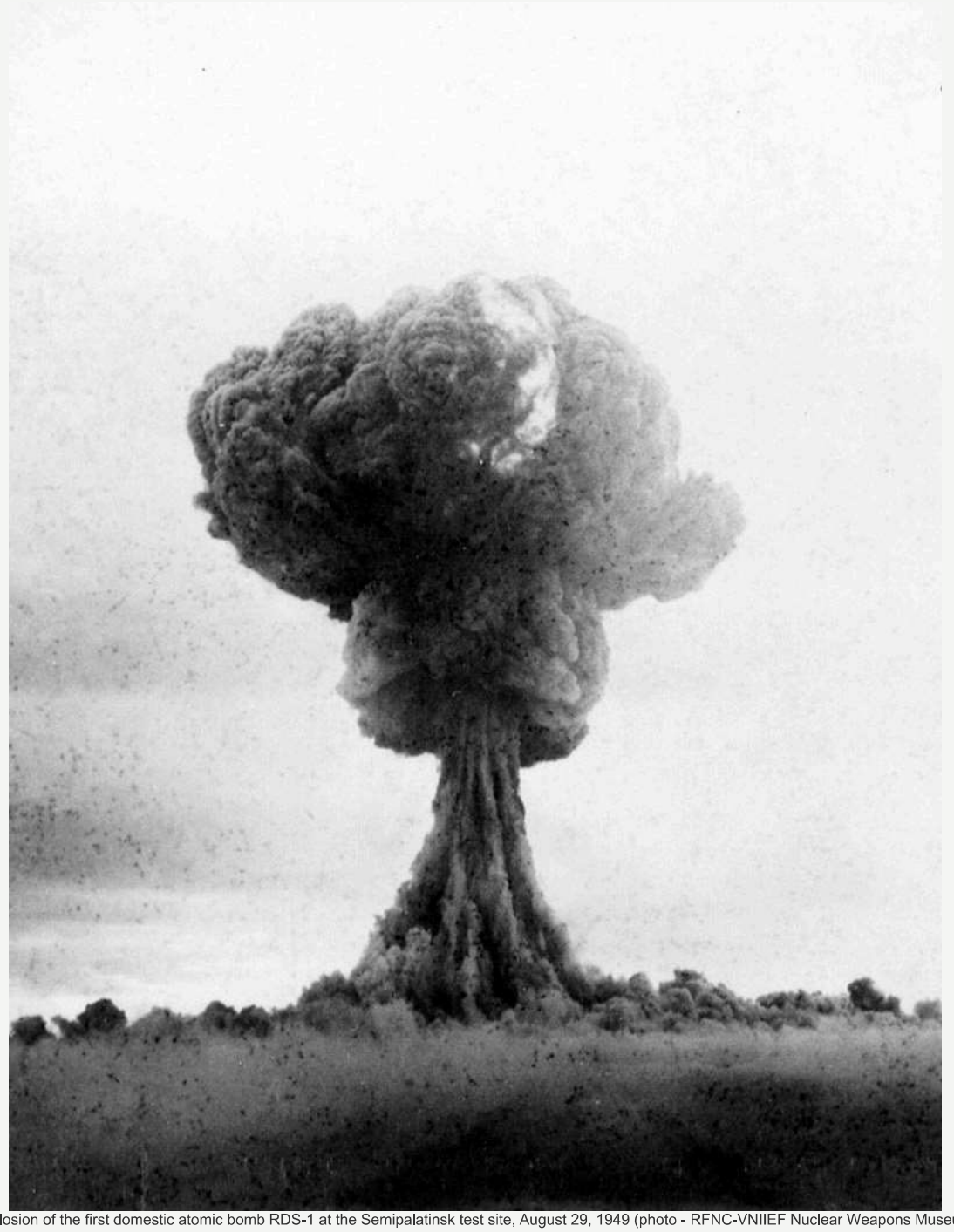
On August 5, 1949, the plutonium charge was accepted by the commission headed by Khariton and sent by a special train to KB-11 on August 8, 1949. By this time, the work on creating the explosive device was almost finished here. In KB-11 in Sarov, on the night of August 10-11, a control assembly of the nuclear charge, which received the index 501 for the RDS-1 atomic bomb, was carried out. After that, the device was dismantled, the parts were inspected, packed and prepared for shipment to the test site. Thus, the Soviet atomic bomb was made in 2 years 8 months (in the USA it took 2 years 7 months) - (source). On August 21, 1949, the main charge and three neutron fuses arrived at the Semipalatinsk test site.

The bomb tests were planned to be conducted in 1949 at Test Site No. 2, 170 km west of Semipalatinsk. The test site was built and equipped for atomic tests in accordance with the Resolution of the USSR Council of Ministers No. 2142-564ss/op of June 19, 1947. It was decided to conduct the first test of the bomb by placing it on a metal tower 33 m high (37.5 m - *source RDS-1...*) without a ballistic casing and instruments that are required when using a bomb from an aircraft (*source - Project...*).

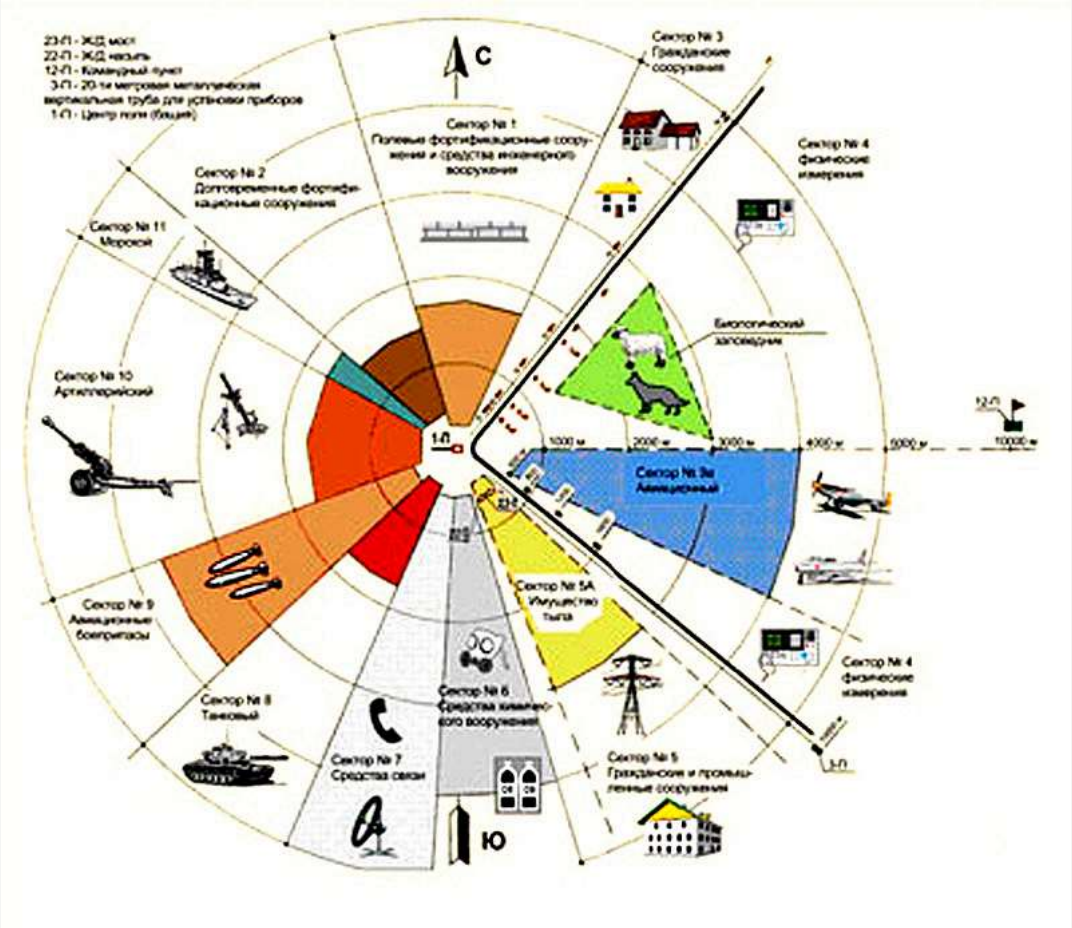


The tower on which the charge of the first domestic atomic bomb RDS-1 was placed. Nearby is the assembly building. The testing ground near Semipalatinsk, 1949 (Rosatom).

The first domestic atomic bomb RDS-1 was tested on August 29, 1949 at 7 am local time at the Semipalatinsk test site (170 km west of Semipalatinsk). At the site of the tower with the bomb, a crater 3 m in diameter and 1.5 m deep was formed, covered with a molten glass-like substance, the radiation level at the epicenter was 0.5 Sv/s, it was allowed to be 2 km from the epicenter for no more than 15 minutes. 25 m from the tower there was a building made of reinforced concrete structures, with an overhead crane in the hall for installing the plutonium charge into the explosive charge. The structure partially collapsed, the structure itself survived. Of the 1,538 experimental animals (dogs, sheep, goats, pigs, rabbits, rats), 345 died as a result of the explosion (some animals imitated soldiers in trenches). The T-34 tank and field artillery were slightly damaged within a radius of 500-550 m from the epicenter, and at a distance of up to 1500 m all types of aircraft were significantly damaged. At a distance of one kilometer from the epicenter and then every 500 meters, 10 passenger cars "Pobeda" were placed, all 10 cars burned. At a distance of 800 m, two residential 3-story houses, built 20 m from each other, so that the first screened the second, were completely destroyed, residential panel and log houses of the urban type were completely destroyed within a radius of 5 km. Most of the damage was caused by the shock wave. The railway (1000 m) and highway bridges (1500 m) were mangled and thrown 20-30 m from their place. The carriages and cars located on the bridges, half-burnt, were scattered across the steppe at a distance of 50-80 m from the place of installation. Tanks and guns were overturned and mangled, animals were carried away (*source RDS-1...*).

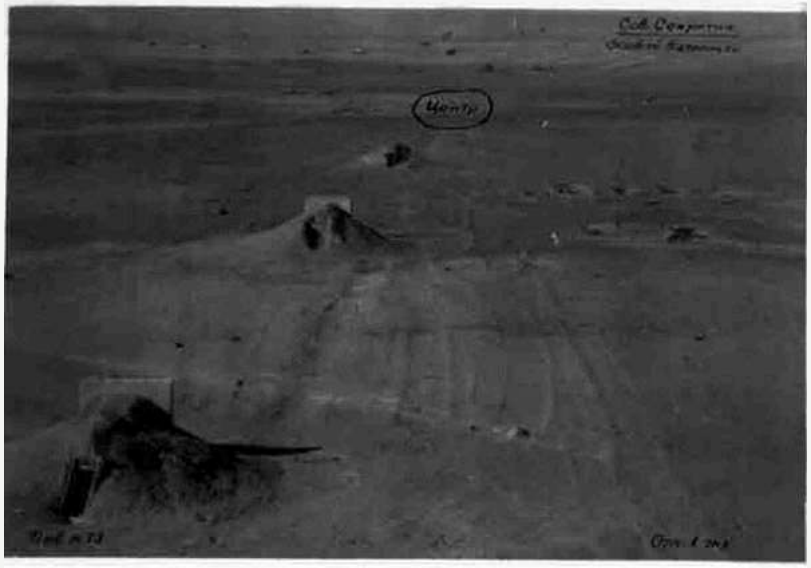


Explosion of the first domestic atomic bomb RDS-1 at the Semipalatinsk test site, August 29, 1949 (photo - RFNC-VNIIEF Nuclear Weapons Museum, http://rusarchives.ru).



Map of the experimental field sectors during the first test of the RDS-1 bomb, August 29, 1949 (http://old.vniief.ru).

Центральная башня до опыта.



Центральная башня после опыта (снято с дистанции 500 м)

Photographic evidence of the results of the atomic weapons test on August 29, 1949. Appendix to the report of L.P. Beria and I.V. Kurchatov to I.V. Stalin on the preliminary data obtained during the test of the atomic bomb. The central tower before and after the experiment (taken from a distance of 500 m). August 29, 1949 (http://rusarchives.ru/school).

Фото №2.

Промышленное здание с железо-бетонными несущими рамами и кирпичным заполнением в 1,5 кирпича (38 см) до опыта

Дистанция 500 м

Фото №2а.

То же здание после опыта.

Photographic evidence of the results of the atomic weapons test on August 29, 1949. Appendix to the report of L.P. Beria and I.V. Kurchatov to I.V. Stalin on the preliminary data obtained during the test of the atomic bomb. Industrial building with reinforced concrete supporting frames and brick filling of 1.5 bricks (38 cm) before and after the experiment (distance - 500 m). 08/29/1949 (http://rusarchives.ru/school).

Photographic recording of the results of the test of atomic weapons on August 29, 1949. Appendix to the report of L.P. Beria and I.V. Kurchatov to I.V. Stalin on the preliminary data obtained during the test of the atomic bomb. The La-9 fighter, installed at a distance of 500 m with the engine to the center, before and after the experiment. 08/29/1949 (http://rusarchives.ru/school).

Backup control panel for the test explosion of the RDS-1 charge. Metal, 180 cm x 140 cm x 75 cm. Museum of Nuclear Weapons RFNC-VNIIEF. (http://rusarchives.ru/school).

After the successful first test of the RDS-1 bomb, a decision was made to mass-produce bombs "based on the design tested in 1949... in an aviation version." Resolution of the USSR Council of Ministers No. 5060-1943ss/op of October 29, 1949 established the following bomb production plan (a total of 154 units, including the bomb tested in 1949):
- 1949 - 2 units (except for 1 bomb tested at the testing ground)
- 1950 - 7 units
- 1951 - 18 units
- 1952 - 30 units
- 1953 - 42 units
- 1954 - 54 units

By August 1949, plutonium had been produced for only the first RDS-1 bomb. For the second RDS-1 bomb, which was assembled into ammunition, plutonium was produced only by November 1949. Yu. B. Khariton received two plutonium hemispheres at Combine No. 817 only on November 5, 1949. On

November 18, 1949, a special committee under the USSR Council of Ministers adopted a protocol "On the serial production of finished RDS-1 products". According to this protocol, the final assembly of the products was to be carried out by KB-11. The main production was carried out by Combine No. 817 (plutonium production) and Plant No. 48. In May 1950, KB-11 completed the development of drawing, technical, technological and operational documentation for the RDS-1 aerial bomb (*historical - High glory...*). In the summer of 1950, the first serial bomb RDS-1 produced by KB-11 was released.

By the beginning of 1951, assembly of atomic bombs was carried out in KB-11; production of individual units and parts of the bomb was organized at several enterprises:
- plutonium charge - combine No. 817;
- spherical charge - plant No. 80 of the Ministry of Agricultural Machinery;
- hulls - plant No. 48 of the Second Main Directorate;
- automation - plant No. 25 of the Ministry of Aviation Industry;
- central metal part and neutron fuses - KB-11.

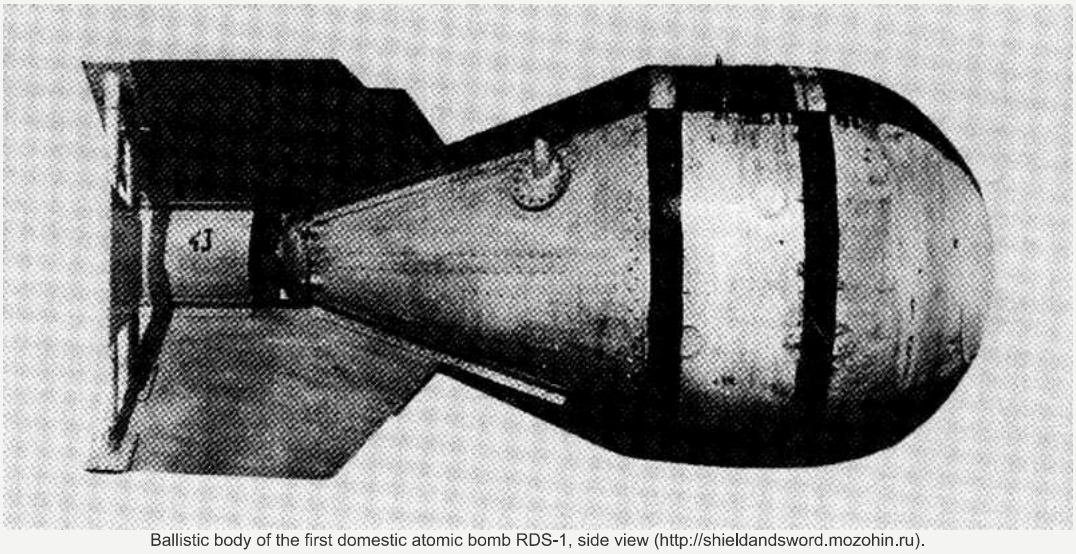
In order to increase serial production of nuclear weapons, in 1949 the creation of plant No. 551 was started (also known as plant No. 3 of KB-11, the future electromechanical plant "Avangard"). The first three serial RDS-1 bombs were produced by Plant No. 551 in December 1951 - the bombs were equipped with charges assembled by the KB-11 experimental plants. In 1951, the production of RDS-1 bombs by KB-11 was discontinued.

In order to conduct control and flight tests of serial products, by decision of the Government in 1951, a military assembly brigade (VSB) was created in KB-11. The task of the VSB was to assemble the munition in the warehouse and finally prepare it at the airfield for combat use. During its stay at Plant No. 551, the assembly brigade was used to manufacture and assemble units of products 501 and 501M.

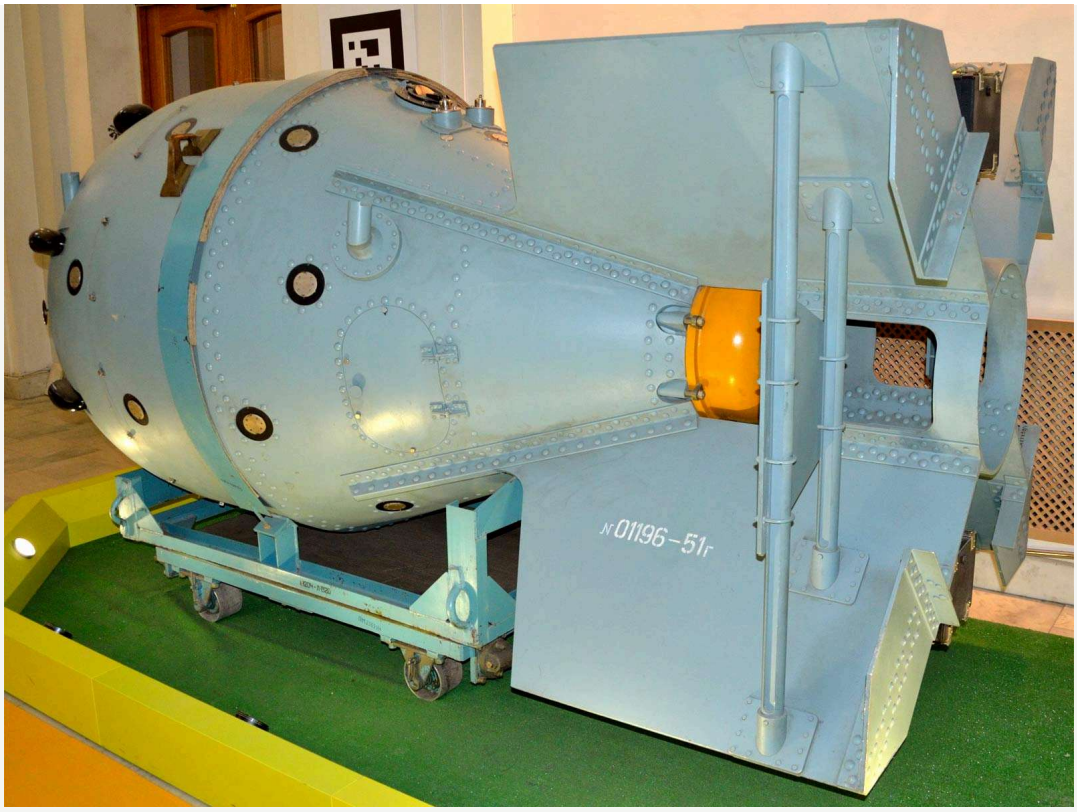
In 1952-1953, all 29 RDS-1 bombs produced by KB-11 were converted into RDS-2 bombs.

Design- the RDS-1 bomb is made in the form of a free-falling bomb of large diameter and mass. The charge of the atomic explosive device is made of plutonium. Presumably, the design of the RDS-1 bomb was largely based on the design of the Fat Man bomb (USA). At the same time, the ballistic body of the bomb and electrical equipment were of domestic design.
Structurally, the atomic bomb included:
- a nuclear charge
- a ballistic body of a large-diameter aerial bomb
- an explosive device and equipment for automatic charge detonation systems with safety systems

Atomic bomb "Fat Man", USA (http://shieldandsword.mozohin.ru).



Ballistic body of the first domestic atomic bomb RDS-1, side view (http://shieldandsword.mozohin.ru).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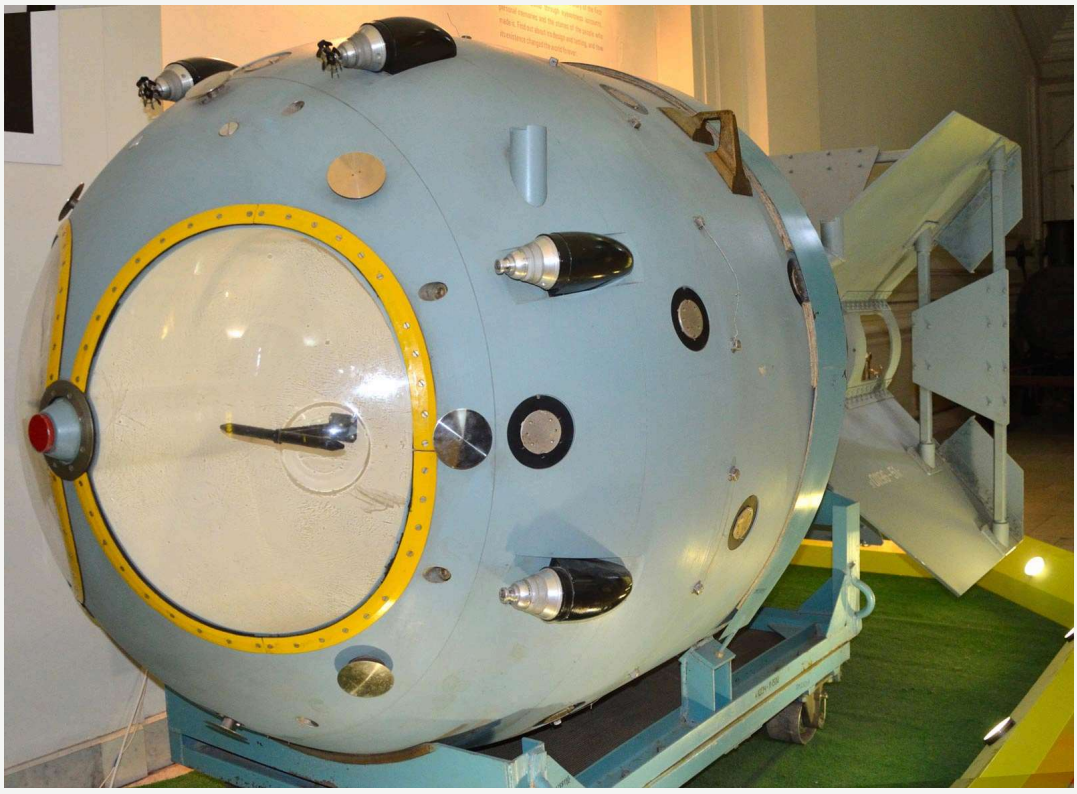
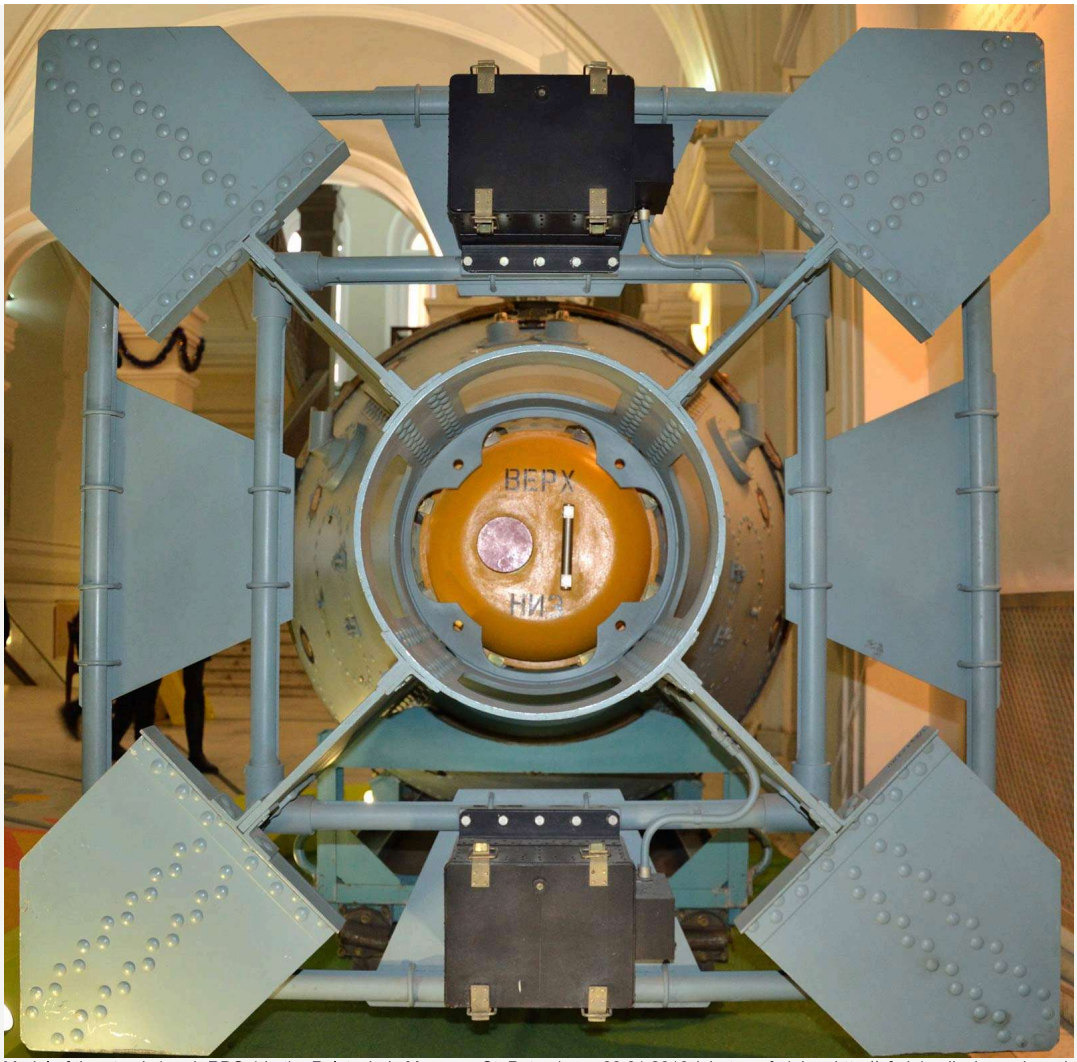
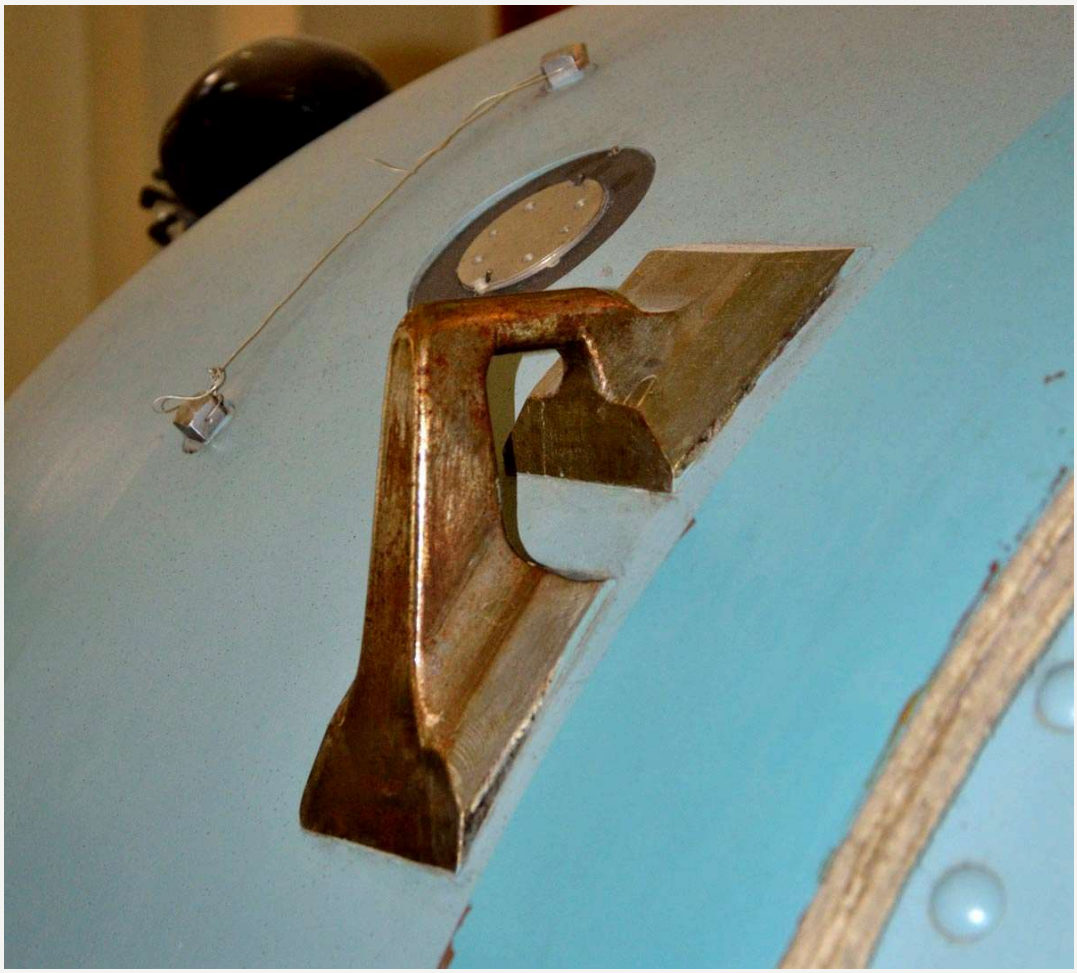




Model of the atomic bomb RDS-1 in the Polytechnic Museum, St. Petersburg, 03.01.2013 (photo - pfc-joker, http://pfc-joker.livejournal.com).



Eye for suspension under the carrier on the model of the atomic bomb RDS-1 in the Polytechnic Museum, St. Petersburg, 03.01.2013 (photo - pfc-joker, http://pfc-joker.livejournal.com).

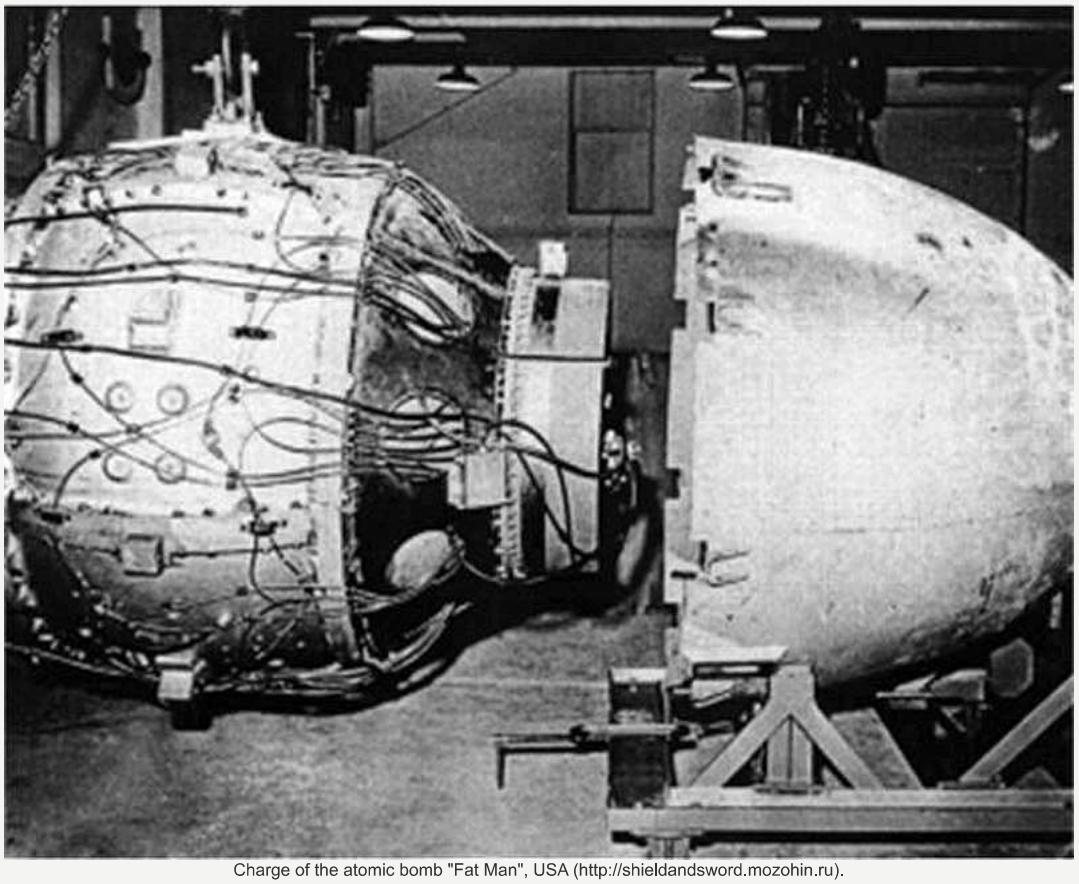
Bomb performance characteristics :
Length:
- 5000 m (maximum according to the 1946 TTS)
- 3340 mm (*source - Technical characteristics...*)
Maximum diameter:
- 1500 m (maximum according to the 1946 TTS)
- 1500 mm
Maximum tail span - 2085 mm (*source - Technical characteristics...*)
Distance from the nose cut to the suspension lugs - 1130 mm (*source - Technical characteristics...*)
Drag coefficient - 0.8 at M 0.5-0.8 (*source - Technical characteristics...*)
Bomb oscillation angles relative to the tangent to the trajectory when dropped from an altitude of 10,000 m - 10 degrees +-5 degrees (*source - Technical characteristics...*)

Bomb weight:
- 5000 kg (maximum according to the TTZ 1946)
- 4600 kg +-100 kg (*source - Technical characteristics...*)

Dropping altitude (guaranteeing the device's operation) - 5000-10000 m (*source - Technical characteristics...*)
Bomb explosion altitude - from 200 to 600 m (*source - Technical characteristics...*)
Final fall speed when dropped from a height of 10,000 m - 260 m/s +-12 m/s (*source - Technical characteristics...*)
Fall time from a height of 10,000 m - 54.8 +-2 sec (*source - Technical characteristics...*)
Characteristic fall time - 21.4 sec (*source - Technical characteristics...*)

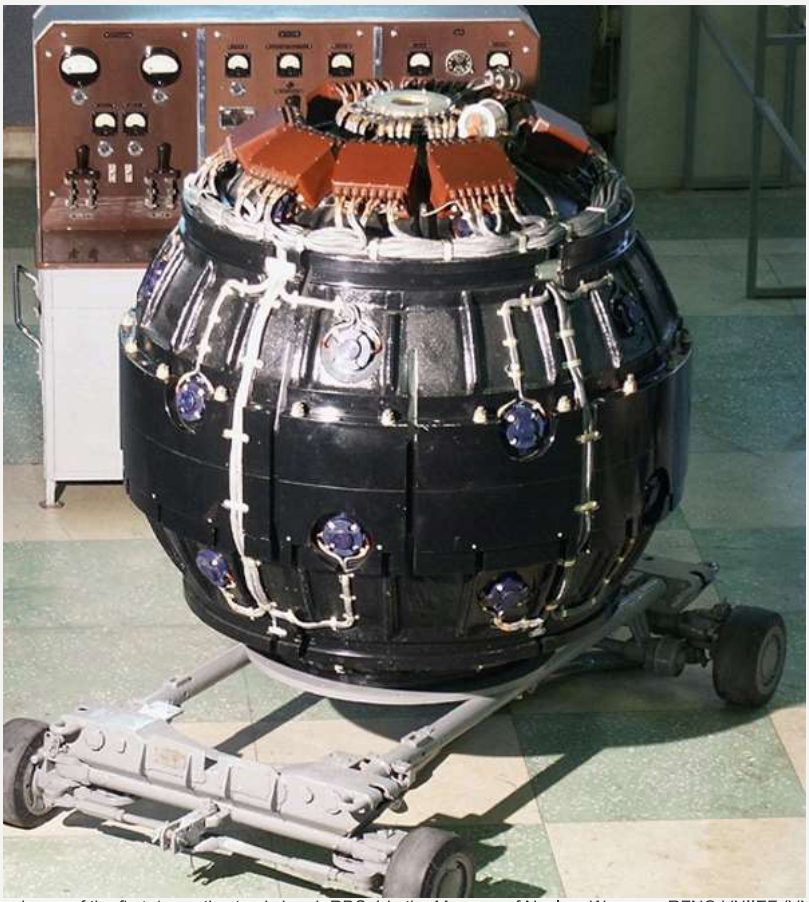
TNT equivalent:
- not less than 10,000 tons (according to the design and in fact, *source - Design...*)
- 22,000 tons (actual, first explosion according to later data)
- 18,500 tons (serial bombs, *source - Zavalishin*)

Warhead type - plutonium (Pu-239) atomic charge "1-200" of the implosion type, in some sources it is the charge that is called "product 501" (and not the bomb itself). To ensure the simultaneous explosion of the compression charge of conventional explosive (a mixture of TNT and hexogen in a ratio of 1:1 - TG 50/50), a new type of electric detonator was developed - the 1-042-Sb.2 detonator cap (serial production began in 1952 at Plant No. 253 of the Ministry of Defense Industry in Murom).
Number of initiation points of the compression charge of explosive - 32 pcs.
Plutonium mass - 6.4-6.5 kg
Mass of the charge of conventional explosive - approx. 2400 kg (source)
Diameter of the plutonium charge - approx. 90 mm
Calculated efficiency of the charge - approx. 10% (*source - Project...*)
The estimated probability of an explosion with a reduced efficiency factor is about 10% (including a 5% probability of an explosion with an equivalent of 3,000 to 10,000 tons of TNT and a 5% probability of an explosion with an equivalent of less than 3,000 tons, but in any case not less than 300 tons of TNT) - (*source - Project...*).



Charge of the atomic bomb "Fat Man", USA (http://shieldandsword.mozohin.ru).

Atomic charge of the first domestic atomic bomb RDS-1 (http://shieldandsword.mozohin.ru).

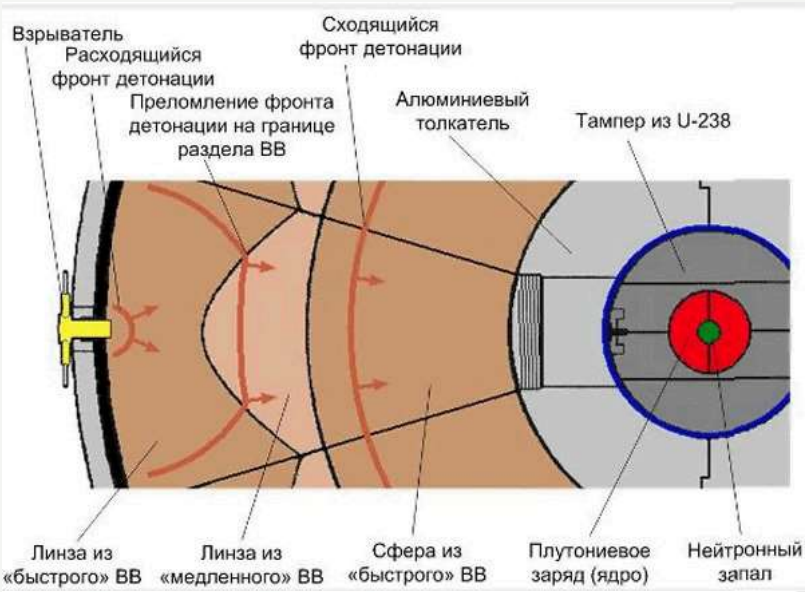


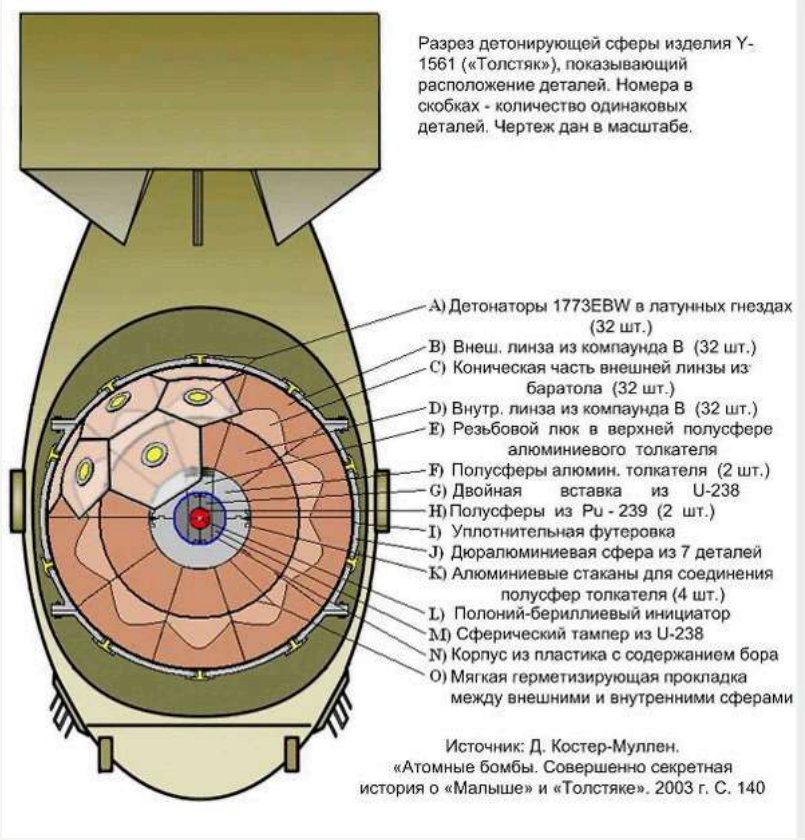
Atomic charge of the first domestic atomic bomb RDS-1 in the Museum of Nuclear Weapons RFNC-VNIIEF (VNIIEF).

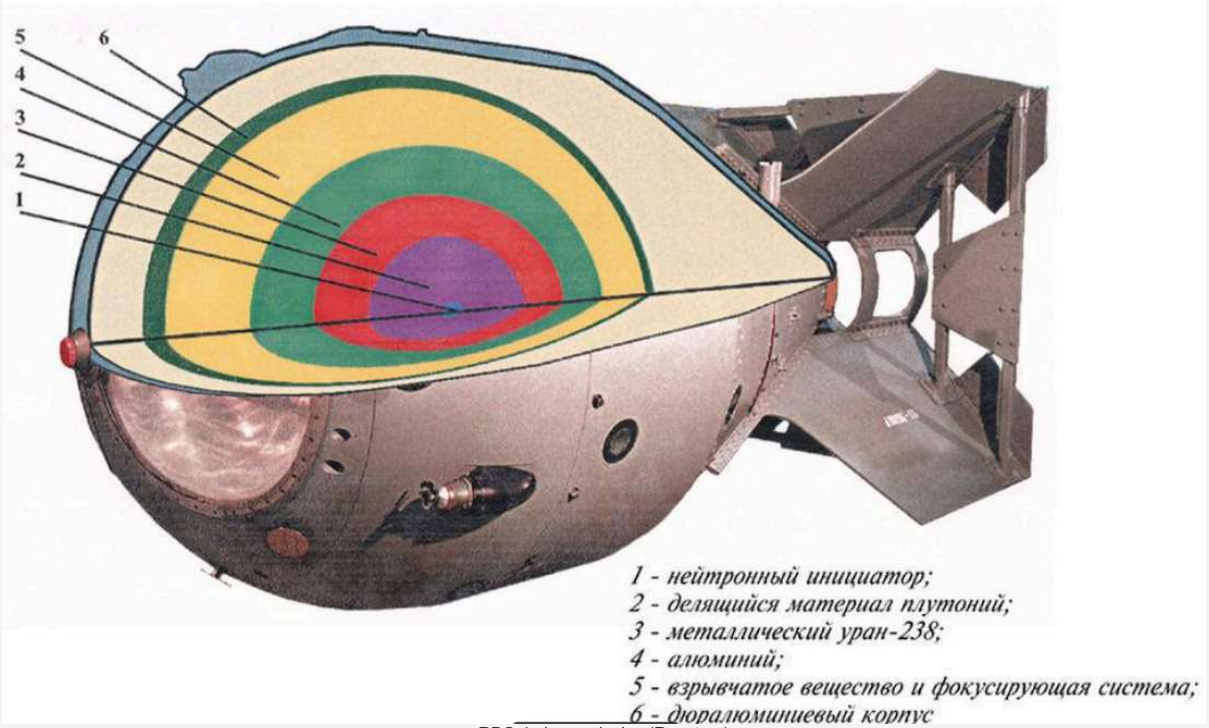
The atomic charge was made in the form of a multilayer structure, in which the transition of plutonium to a critical state was carried out by compression by a converging spherical detonation wave of a conventional explosive. In the center of the charge there was 6 kg of plutonium, in the form of two hollow hemispheres, surrounded by a massive shell of uranium-238 (tamper). This shell served for inertial containment of the core swelling during the chain reaction, so that as much of the plutonium as possible had time to react and, in addition, served as a reflector and moderator of neutrons (neutrons with low energies are most effectively absorbed by plutonium nuclei, causing their fission). The tamper was surrounded by a shell of aluminum that ensured uniform compression of the nuclear charge by the shock wave. A neutron initiator (fuse) was installed in the cavity of the plutonium core - a ball about 2 cm in diameter made of beryllium, covered with a thin layer of polonium-210. When the nuclear charge of the bomb is compressed, the polonium and beryllium nuclei come closer together, and the alpha particles emitted by the radioactive polonium-210 knock neutrons out of the beryllium, which initiate a chain nuclear reaction of fission of plutonium-239. One of the most complex units was the explosive charge, which consisted of two layers. The inner layer was two hemispherical bases made of an alloy of TNT with hexogen, the outer layer was assembled from individual elements with different detonation speeds. The outer layer, designed to form a spherical converging detonation wave at the base of the explosive, was called the focusing system. For safety reasons, the unit containing the fissile material was installed immediately before using the charge. For this purpose, the spherical charge of the explosive had a through conical hole, which was closed with a plug made of explosive, and the outer and inner casings had holes closed with lids. The power of the explosion was due to the splitting of nuclei of about a kilogram of plutonium, the remaining 4 kg did not have time to react and were uselessly dispersed - this drawback was later eliminated in more advanced charges (source).

The nuclear charge was initiated by a neutron fuse (NF) - a neutron source using polonium-210 and beryllium. Information about this type of initiator was

contained, among other things, in intelligence data. It was necessary to update the polonium neutron fuses due to the short half-life of polonium - 140 days. Beginning in 1949, Plant No. 25 began developing a substitute for polonium NF. In 1950, a group of KB-11 specialists headed by A.A. Brisch began developing an external pulsed neutron source (EPNS), which would be tested for the first time as part of an atomic bomb in 1954 and would later completely replace polonium NS. Since 1961, the use and supply of polonium NS to the troops has ceased (*source - Zavalishin*).

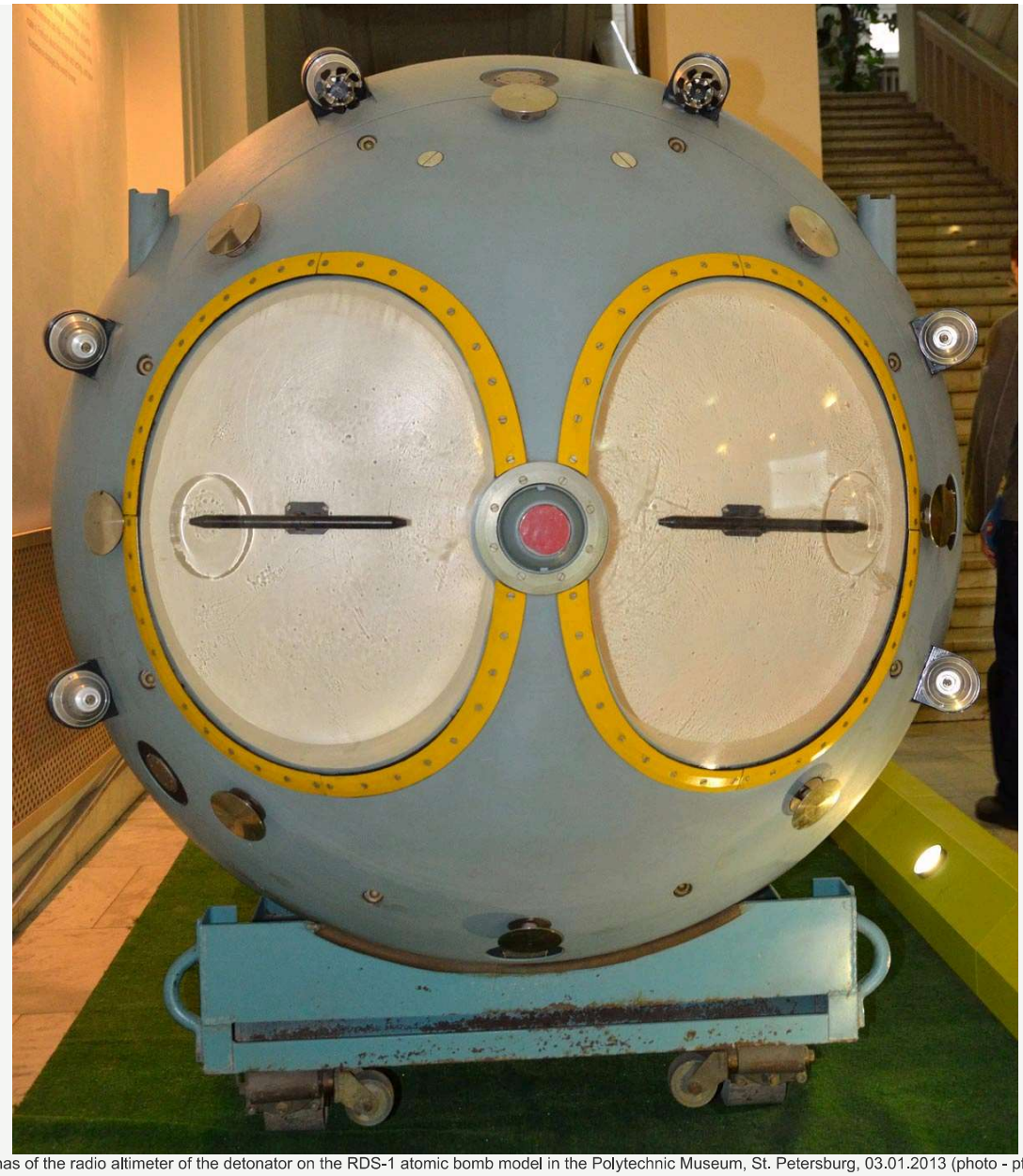






RDS-1 charge device (Rosatom)


Device on the RDS-1 atomic bomb model in the Polytechnic Museum, St. Petersburg, 03.01.2013 (photo - pfc-joker, http://pfc-joker.livejournal.com).

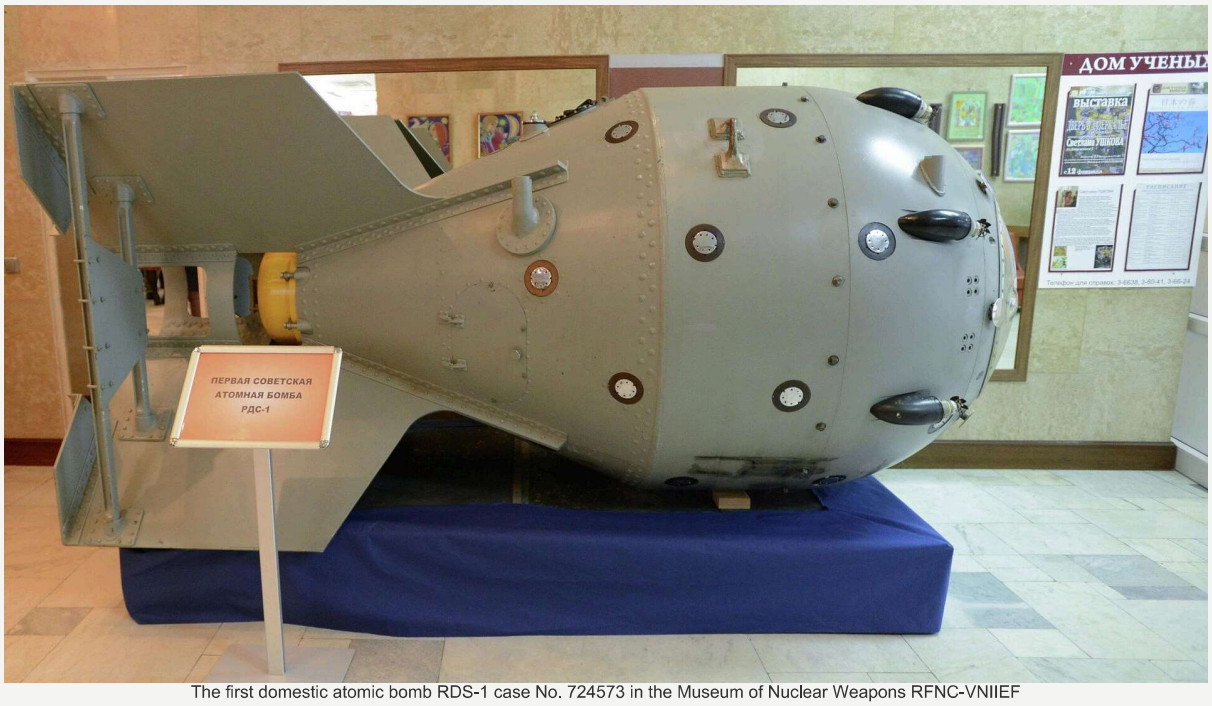


Antennas of the radio altimeter of the detonator on the RDS-1 atomic bomb model in the Polytechnic Museum, St. Petersburg, 03.01.2013 (photo - pfc-joker, http://pfc-joker.livejournal.com).

Modifications :
- RDS-1 / S-1 / product 501 - the first version of the bomb - a plutonium atomic bomb, implosion scheme.

- RDS-2 / S-2 / product 601 - the second version of the bomb, the working substance is uranium-235, "gun" scheme.

- RDS-2 / product 501-M - another version of the bomb - a plutonium atomic bomb. Preparation and, probably, the start of production - 1951. On 12/29/1951, Resolution of the USSR Council of Ministers No. 5383-2343ss/op was adopted on the expansion of Plant No. 551 - one of the reasons was to ensure the production of product 501M. In the first quarter of 1953, a separate plant No. 418 was to begin production of 501M products (Resolution of the USSR Council of Ministers No. 3506-1628ss/op of 15.09.1951) with a capacity of 60 units per year.



The first domestic atomic bomb RDS-1 case No. 724573 in the Museum of Nuclear Weapons RFNC-VNIIEF

Carriers :
- Tu-4 - BULL - heavy bomber. Could carry one RDS-1 bomb. In June 1952, the formation and preparation of a training unit consisting of 22 Tu-4 aircraft (including 7 aircraft and crews trained in 1951) was completed. The base airfield is Balbasovo, 12 km south of Orsha.

Status : USSR - RDS-1 bombs were produced in small series.

- August 29, 1949 - the first domestic atomic explosion - testing of the RDS-1 bomb at the Semipalatinsk test site. Plant No. 817 produced the first plutonium charge in the USSR for this bomb.

- November 5, 1949 - Plant No. 817 produced plutonium for the second RDS-1 bomb (the first serial bomb), which was assembled into ammunition. Yu.B.Khariton received two plutonium hemispheres at the plant.

- 1949 - start of serial production of RDS-1 bombs - only 2 serial RDS-1 bombs were produced in one year, except for the one detonated at the testing ground.

- 1950 February 18 - order No. 49ss-op of the head of the First Main Directorate under the USSR Council of Ministers was adopted on conducting control tests of serial products with assembly and testing at the Air Force testing ground of two RDS-1 products without the main charge.

- 1950 - 9 RDS-1 bombs were produced (with a plan of 7 units).

- 1951 April 25 - there are 18 sets of units for RDS-1 products and 31 sets of elements made of conventional explosives for the same product in the T-20 warehouse - "Memorandum of the employee of the Special Committee M.K. Nikolsky to L.P. Beria on violations of safety requirements during storage of elements made of explosives in KB-11" dated April 25, 1951; "Atomic Project of the USSR", Volume 2, Book 7, p. 250 (source).

- 1951 January-October - 18 RDS bombs were produced (including one RDS-2 and one RDS-3 bomb for testing).

- 1951 November-December - 6 RDS products, including 3 RDS-1 products produced by Plant No. 551 (December 1951). A total of 29 RDS-1 bombs had been produced by the end of 1951 (+1 detonated in 1949). RDS-1 bombs were not delivered to combat units of the USSR Armed Forces. The ammunition

was stored on the territory of KB-11 in Sarov. Production of RDS-1 bombs ceased in 1951.

- 1952 - 19 RDS-1 bombs were converted into RDS-2 bombs .

- 1953 first half of the year - 10 remaining RDS-1 bombs were converted into RDS-2 bombs .

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